

Shadow Learning in Undergraduate Mathematics: an Exploratory Study

Hana Sulieman

Department of Mathematics and Statistics, American University of Sharjah, Sharjah, P.O.Box 26666,
United Arab Emirates
Email: hsulieman@aus.edu

Abstract

Purpose – This study aims to explore the practice of shadow education (private tutoring) in Mathematics among first year university students and to examine how this mode of learning during high school years impact students' performance in freshman mathematics course.

Methodology – Taking a case study of Business Mathematics course at the American University of Sharjah (AUS) in United Arab Emirates (UAE), the author undertook a quantitative analysis of students' final grades in the course categorized by students' responses to some private tutoring related questionnaire items.

Findings – Students who have received private tutoring in Mathematics in the form of individualized instruction for at least one year in high school are more likely to request tutoring in the subject during freshman year at the university. As for performance, students who purchased private tutoring in order to improve their performance in the course consistently underperformed their peers irrespective of whether they had tutoring experience in Mathematics in high school or not. They showed significantly higher failing rate in the course than their peers.

Research limitations – The study did not include other tutoring unrelated factors that could affect students' performance in the course such as students' motivation, household and/or school characteristics.

Implications for teaching – Given the observed negative consequences of private tutoring on students' learning, educators of higher education where tutoring practices may exist should invest time in discouraging these practices and educating their students of the negative effects tutoring can have. They should develop teaching strategies that promote independent learning, give more support to challenged students in Mathematics and encourage peer tutoring and group studying.

Social Implications – Given the cultural context of UAE society, parents are envisaged to take lead and often dictate their children life choices. In their conviction of 'good' parenting, they drive their children into tutoring hoping for them to achieve competitive academic performance. Parents should become aware of the negative consequences that

tutoring can have on their children education and personality.

Originality – There is little research on the long term impact of private tutoring. This paper tries to shed some light on this impact by examining how private tutoring in high school could affect student's learning and performance in freshman Mathematics course.

Keywords

Tutoring; Boxplot; Shadow Education; UAE

Introduction

Private tutoring or so-called "Shadow Education" is a growing industry in both developed and developing countries. In some countries in East Asia, private tutoring accounts for close to 3% of Gross Domestic Product (Dang and Rogers, 2008). Private supplementary tutoring in academic subjects outside school hours for remuneration is described as shadow because it mirrors the mainstream education system in its scope; intensity, size and orientation, and public attention in almost all societies are focused more on mainstream than on its shadow (Bray, 2006). Private tutoring is not a new phenomenon; some reference to it exists principally in the nineteenth century publications. In recent years, it has been growing steadily as a parallel education sector to the mainstream education system and with its growth, there exist an increasing body of literature examining its scope, causes and impacts on learning and livelihood.

While private tutoring may have many positive effects, such as increasing human capital, providing constructive after-school activities for students, and generating additional income for tutors (often under-paid teachers), it also produces a number of negative effects. For example, private tutoring can lower the quality of education provided by the school system as teachers, who often tutor their own students, tend to focus their efforts on private tutoring rather than on their classes,

put pressure on students, exacerbate social inequities, and facilitate the spread of corruption in the education system (Dang and Rogers, 2008; Bray, 2007). In addition, the literature presents no conclusive evidence that private tutoring increases aggregate student achievement at the national level. On the contrary, some argues that it can actually lower the quality of teaching and learning in the classroom if teachers focus their efforts on private tutoring rather than on their classes. Not to forget the leisure time of children contravened by too many hours of studying and may negatively affect their mental, social and physical well-being.

In this paper, we try to shed some light on the practice of private tutoring among first year university students taking a Business Mathematics course at the American University of Sharjah, United Arab Emirates (UAE). The impact of this practice on students' learning measured by their final grades in the course is examined.

Private Tutoring In the Uae

Similar to the situation in many countries around the world, the use of private tutoring in the United Arab Emirates (UAE) is increasingly wide-spreading. The UAE is classified as a high income developing economy by the International Monetary Fund (<http://www.imf.org>). Its population leapt over the 8 million mark in 2011, most of whom (about 88%) are expatriates who come from Asia, Arab countries and Western and European countries and reside in the country for employment purposes.

A substantial number of high school students in both public and private education schools in UAE opt for private tuitions and experts have attributed this to a peer pressure, high competition in university admission, weakness in school education system and a trend brought on by expatriate teachers from countries where this practice is common. Numerous reports have appeared in the country's media illustrating some of the negative impacts of private tutoring on students and their families. According to the Abu Dhabi Department for Economic Development, 27% of Emirati families spend on average 1,436 AED (390 USD) per month on private tuitions which works out to 4.8% of their household expenditure (Ahmed, August 24, 2010).

In a recent study conducted by the Dubai School of Government (Farah, 2011) more than 65% of Emirati students attend private tutoring lessons in the final year of high school. This figure is significantly higher than the 51% reported in 2009. 53% of the surveyed students

reported participation in private tutoring in one or more earlier grades. The study found that boys are significantly more likely to take private tutoring than girls. Among all subjects tutored, mathematics and physics were the most popular across genders with boys more likely than girls to receive tutoring in mathematics. Over 80% of the participants who received private tutoring claimed that it had some positive impact upon their studies while about 85% of them agreed to the statement that taking private tutoring was the only way to graduate from school or get good education. As for the private tutors, the study reported that 82.5% of tutors were men and 52.5% of them found tutoring their classroom students. The practice of tutoring their own students has been shown in the literature to lead to favoritism and other forms of corruption in the education system.

Research Questions and Method

Several studies have appeared in the literature that attempted to assess the impact of private tutoring on students' learning. As Dang and Rogers (2008) explained, some caution needs to be exercised when interpreting the results of these studies due to the complex nature of private tutoring. There are various unobserved but important factors that influence the learning returns of private tutoring such as students' characteristics, parents' characteristics and schools' characteristics. For the few studies that controlled for some of the unobserved factors in some credible way, there were some contrasts in the results concerning the effectiveness of private tutoring on pupil's learning. It was found to have positive impact on student performance on national tests (Unal *et al.*, 2010; Banerjee *et al.*, 2007; UK news: Education + Training, 2005) and on university entrance examinations (Tansel and Bircan, 2005). Private tutoring was also found to significantly increase the quality of universities students attend in Japan (Ono, 2007). In contrary, Cheo and Quah (2005) found that private tutoring may be counter-productive because of the overload on the children in Singapore. Paviot *et al.* (2005) reported that surveys in Kenya, Malawi and Zambia found no significant differences in the performance of children who received tutoring and those who did not.

The populations considered in these studies and other research articles are the primary, lower and upper secondary schools' students. No attempt was taken to investigate the long term impact of private tutoring on academic performance of students in post-secondary education. In this exploratory study we try to shed

some light on the private tutoring practices among university students taking freshman Mathematics class and examine the extent to which tutoring during upper-secondary (high) school impact students' academic capacity and performance in Mathematics during first year university education. We pose the questions:

- Which students are more likely to seek private supplementary instruction while attending first year university Mathematics course?
- Is there a significant difference in the end-of-semester Mathematics scores between students who purchased private tutoring during high school and those who did not?
- Is there a significant difference in the end-of-semester Mathematics scores between students who purchased private tutoring while taking first year university Mathematics course and those who did not?

The sample includes 152 students enrolled in first year Business Mathematics course at the American University of Sharjah, UAE, in Fall 2010. Nearly 90% of these students were freshmen students while the rest were at least sophomore students who were repeating the course for second or third time. The course had six sections taught by three different instructors. At the end of the semester, the students were asked about the study strategies and learning aids they utilized outside classroom hours to help them improve performance in the course. These study strategies were classified as: studying independently the course material which includes lecture notes, textbook and other supplementary material provided by instructor and not requiring the help of peer or tutor; seeking additional help from peers or/and instructor and seeking additional help from a private tutor. The students were also asked about whether they had private tutoring experience in Mathematics in high school or not and how they perceive the effectiveness of private tutoring in helping them perform well in Mathematics. Their responses were then linked to their final grades in the course so as to provide quantitative basis for the analysis of the results.

Findings

To eliminate the instructor effect on the analysis results, the grades (100-point scale) were first standardized by subtracting the corresponding average score and dividing by standard deviation. Multiple t-tests were

used to compare the standardized grades for different groups of students based on their responses to private tutoring related questions. 5% level of significance is used as a nominal value to declare significance.

Of the students surveyed, 24% were independent learners who study course material on their own without the help of their peers or private tutor. 66% of them reported that, in addition to studying on their own, they utilized the help of their peers and some from the instructor during office hours and extra hours requested by appointment. One form of peer help is obtained from the Mathematics Learning Center which offers free-of-charge; drop-in and one-to-one tutoring service in all mathematics courses ranging from developmental to 200-level courses. The tutors in the center are qualified senior Mathematics majors who have passed certain selection criterion and attended a short training course on tutoring. 10% of the students acquired the additional help of private tutor who tutored them regularly (3%) or when needed (before exams) (7%). The form of tutoring received is one-to-one individualized instruction.

Table 1 shows the counts and percentages of students classified by the learning support method they reported (independent learning, peer help and private tutor) and whether the student had private tutoring experience in high school. Six students did not answer either one of the two questions.

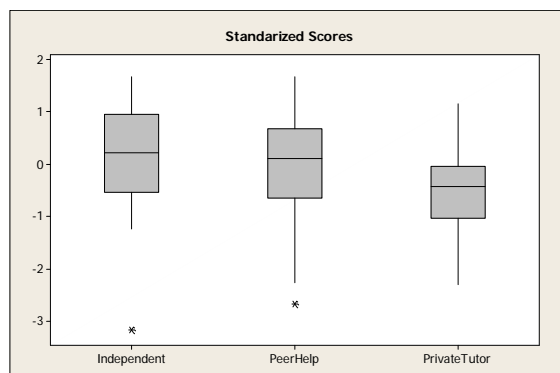
The results clearly show students who received private tutoring in high school in Mathematics are more likely (64%) to continue seeking private tutoring in the subject in first year university than those who did not have private tutoring experience in high school (36%). On the other hand, the likelihood that a student who received private tutoring in high school becomes independent learner while attending university is about 31% compared to 69% for those who did not receive tutoring in high school. It should be mentioned that among the 11 independent learners who had tutoring experience in high school, 81% of them have had private tutoring in Mathematics during only the last year of high school compared to 40% for the 37 students who were seeking peer help and 25% for the 9 private tutored students. The rest of the students in each group have received private tutoring in Mathematics for two or three years of high school. This suggests that students who have longer years of experience in receiving tutoring in Mathematics in high school are more likely to request tutoring in the subject in the freshman year of university education.

TABLE 1 TWO-WAY CLASSIFICATION OF STUDENTS BY

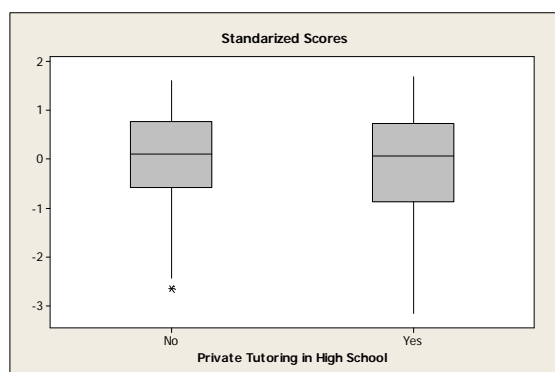
LEARNING METHOD AND BY HIGH SCHOOL TUTORING EXPERIENCE

Learning Method	Tutoring experience in High school		Total
	NO	Yes	
Independent	24 (69%)	11 (31%)	35
Peer help	60 (62%)	37 (38%)	97
Private tutor	5 (36%)	9 (64%)	14
Total	89	57	146

The following box-plot charts depict the comparisons of the standardized final grades in the course for students from different classifications according to private tutoring related experiences. The line in the middle of the box in each plot represents the median (center) of the scores' distribution. The asterisk points at the lower end of the box indicate unusually low values.



(a)



(b)

FIGURE 1 BOX-PLOTS OF STANDARDIZED FINAL SCORES CATEGORIZED BY (A) LEARNING METHOD AND (B) TUTORING EXPERIENCE IN HIGH SCHOOL

Box-plot (a) in Figure 1 shows the comparisons between students' scores in the three learning groups (independent, peer help and private tutor). It is obvious that the private tutor group scored the least on average. Pairwise t-tests indicate that the private tutor group scored significantly less than the independent learners

(p -value=0.02) but not significantly less than the peer help group (p -value=0.06). The independent learners and the peer help group did not show significant difference between their average scores (p -value=0.28). It should be mentioned that 58% of the private tutor students had failing grade in the course compared to 26% of the peer help students and 21% of the independent learners group. One can question the motivation of the students to purchase private tutoring in university level Mathematics and whether their grades will be worse if they did not purchase tutoring. Few studies have addressed the question of motivation for seeking tutoring in the formal school system and shown that motivation is one of the unobservable factors that could significantly affect the effectiveness of tutoring. Bray (2006) explained that some tutees join tutoring because of peer pressure while more motivated tutees join tutoring so as to master the subject and outperform their peers. While our collected data do not reveal what motivate students to seek private tutoring in the course other than improving performance, it is reasonable to believe that Business majors taking a required prerequisite Mathematics course are primarily drawn to private tutoring to achieve a pass in the course so that they can move on with their major courses in business. They do not aim at outperforming their peers in the course or mastering course topics. Majority of them seek tutoring when faced with difficulties in the course material causing them apprehension of failing the course. Purchasing private tutoring when challenged with Mathematics seems very logical thing to do for some of them as this has been the strategy adapted and encouraged by their parents during formal school education. In terms of the cost, it is much cheaper to pay for the tutoring than to pay the costs of repeating the course.

Plot (b) in Figure 1 shows the standardized scores for students who had private tutoring experience in high school and students who did not have that experience. There is no significant difference in the average score (data center) between the two groups (p -value ~1). While tutoring was effective in helping majority of the students graduate from high school and possibly outperform their high school peers, it did not necessarily equip them with sufficient skills that allow them to perform better in university education than those who did not receive tutoring in high school. There could be some tutoring unrelated reasons for the two groups of students to perform at the same level. This result, however, prompts one to question the tutors and their competency in tutoring Mathematics curriculum at

university level. The tutors are usually high school teachers (university professors are prohibited by law from engaging in this practice) who have been teaching their tutees for some years. While they were successful in providing effective teachings that allowed their tutees to graduate from high school, outperform their peers and meet the competitive university admission standards they seem less effective in tutoring university level Mathematics.

In Figure 2 the standardized scores for students who received private tutoring in Mathematics in high school and those who did not were separated. The box-plot charts in the figure show the comparisons of the scores in each group by the learning method used in the course. It is evident that students who purchased private tutoring to help them improve performance in first year Mathematics course consistently underperformed (not significantly) their peers regardless whether they had private tutoring experience in the subject during high school years or not.

It is interesting to report that 55% of the students who received tutoring in Mathematics in high school agreed to the statement that this experience has been effective in facilitating their learning of the subject during first year university. It is unclear if these students truly felt that without their tutoring experience in high school they would have had more difficulty in their learning of first year university Mathematics and possibly performed worse than what the data has revealed or perhaps they simply did not want to report that tutoring did not have any impact. 17% of them also agreed that receiving private tutoring in Mathematics during first year university is necessary for better performance compared to 9% for those who did not have tutoring experience high sch.

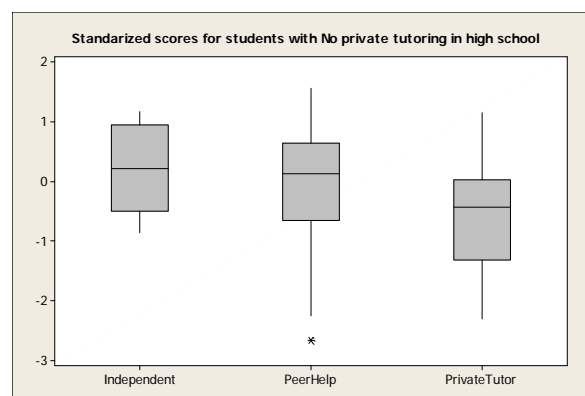
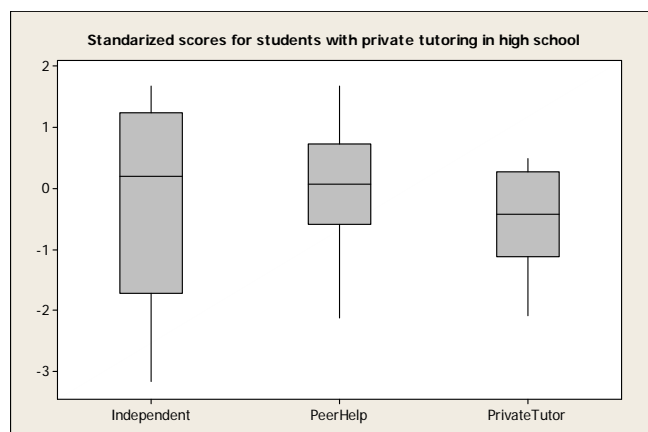


FIGURE 2 BOX-PLOTS OF STANDARDIZED FINAL SCORES OF THE THREE LEARNING METHODS FOR STUDENTS WITH AND WITHOUT TUTORING EXPERIENCE IN HIGH SCHOOL

Conclusions

This exploratory study represents a first attempt to examine the long term impact of private tutoring in high school on students' learning of Mathematics in first year university. The findings show that students who received tutoring in Mathematics in high school are more likely to request tutoring in the subject during the freshman year and less likely to become independent learners than those who did not receive tutoring in high school. As for performance, it is shown that students who purchased private tutoring while attending a freshman Business Mathematics course performed significantly less than those who did not purchase tutoring in the course. Similar performance patterns were seen for these students irrespective to whether they had private tutoring experience in Mathematics in high school years or not.

On the whole, the effectiveness of private tutoring in either high school or first year university on students' learning of university Mathematics was found insignificant in this study. Students who received tutoring in high school and continued to receive tutoring while taking first year university Mathematics showed significantly higher failing rates in the course than their peers. The results raise the question of competency of the tutor, usually a high school teacher, in tutoring university Mathematics curriculum. However, we should mention that there could be some other unobservable factors or tutoring unrelated reasons for the results obtained in this study.

ACKNOWLEDGEMENTS

The author gratefully acknowledges the financial support of the American University of Sharjah, United Arab Emirates.

REFERENCES

- [1] Ahmed. Private tutoring becoming a trend in the UAE. Khaleej Times, August 2010.
- [2] A.V. Banerjee, S. Cole, E. Duflo. And L. Linden. Remedying education: Evidence from two randomized experiments in India. *Quarterly Journal of Economics*, **122**(3), 1235-1264. (2007).
- [3] M. Bray. Private supplementary tutoring: comparative perspectives on parents and implications. *Compare*, **36**(4), 515-530. (2006).
- [4] M. Bray. The shadow education system: Private tutoring and its implications for planners. Paris: International Institute for Educational Planning, UNESCO. (2007).
- [5] R. Cheo, and E. Quah. Mothers, maids and tutors: an empirical evaluation of their effect on children's academic grades in Singapore. *Education Economics*, **13**(3), 269-285. (2005).
- [6] H. Dang and E. Rogers. The growing phenomenon of private tutoring: Does it deepen human capital, widen inequalities or waste resources? *The World Bank Research Observer*, **23**(2), 161-200. (2008).
- [7] S. Farah. Private tutoring trends in the UAE. Dubai School of Government, *Policy Brief* 26. (2011).
- [8] Navarra-Madsen, J. and P. Ingram. Mathematics tutoring and student success. *Procedia Social and Behavioral Sciences*, No. 8, 207-212. (2010).
- [9] H. Ono. Does examination hell pay off? A cost-benefit analysis of 'Ronin' and college education in Japan. *Economics of Education Review*, **26**(3), 271-284. (2007).
- [10] L. Paviot, N. Heinsohn and J. Korkman. The association between extra tuition and student achievement. Paper prepared for the International SACMEQ Educational Policy Research Conference, UNESCO International Institute for Educational Planning, Paris. (2005).
- [11] A. Tansel and F. Bircan. Demand for education in Turkey: A Tobit analysis of private tutoring expenditures. *Economics of Education Review*, **25**(3), 303-313. (2006).
- [12] UK news: "Private tuition a waste of money?" *Education + Training*, **47**(8/9). (2005).
- [13] H. Unal, E. Ozkan., S. Milton, K. Price and F. Curva. The effect of private tutoring on performance in mathematics in Turkey: A comparison across occupational types. *Procedia Social and Behavioral Sciences*, No. 2, 5512-5517. (2010).